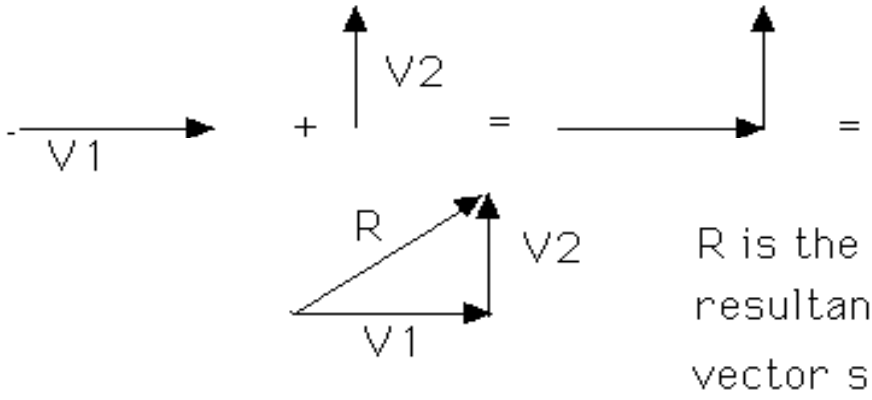
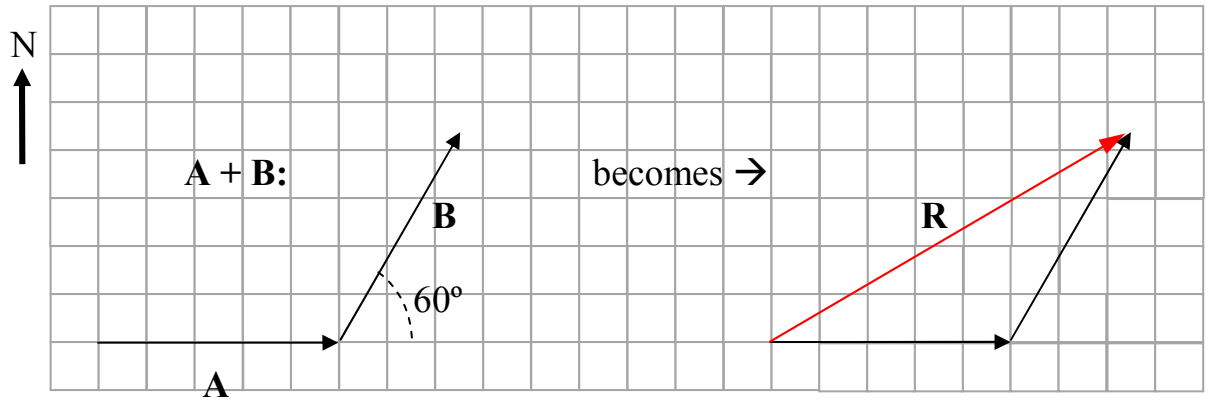
Vector Addition

Make a diagram in which the vectors are placed one after another, the tail of the second vector on the head of the first. This is the tip-to-tail method.



Example 1.
A man walks 250 meters due east (vector A), then 250 meters 60º north of east (vector B). Using scale diagrams on graph paper, determine the magnitude and direction of the resultant displacement.

- Adopt an appropriate scale (e.g. 1 square side = 50 m)
- Note that the correct length of vector B must be measured first, then drawn on the grid.
- Vector-add **A** + **B** by drawing each vector tip-to-tail. Then draw the resultant vector from the start-position to the finish-position.



- Now measure length **R**. This should be done by measuring the number of grid lengths, multiplied by 50 m. Measured correctly, **R** should equal approximately 433 m.

- Finally, use a protractor to find the direction of **R**. This angle should be measured relative to either a horizontal (east/west) or a vertical (north/south) grid line.
- The answer: **R = 433 m at 30° N of E**

Example 2.
Add the displacements $D_1 + D_2 + D_3 = R$ where $D_1 = 6$ km north, $D_2 = 3$ km east, and $D_3 = 4$ km (45° S of E).

(see Vectors Ex 2 for answer)

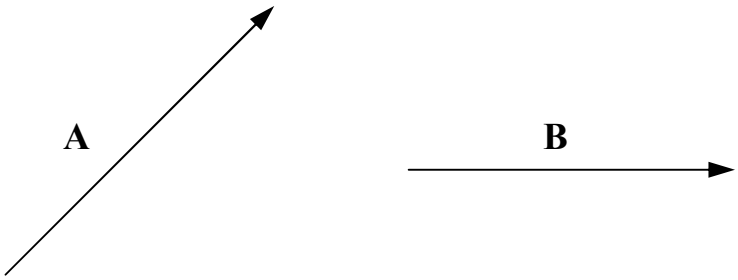
Vector Subtraction

In algebra, subtracting a number is the same as adding the opposite of that number. For example:

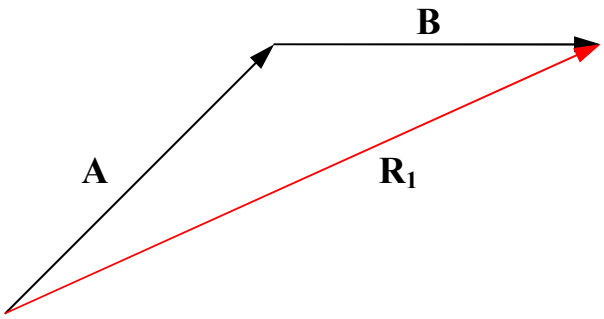
$$16 - 11 = 16 + (-11) = 5$$

Think about vector opposites. Given a vector **B** that points due east, **-B** is just the other direction from **B**, but with the same *magnitude* (the term 'magnitude' means size):

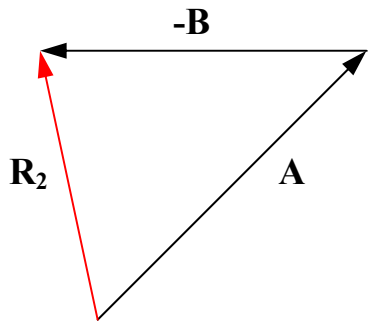
Now consider two vectors, **A** and **B**, as follows:



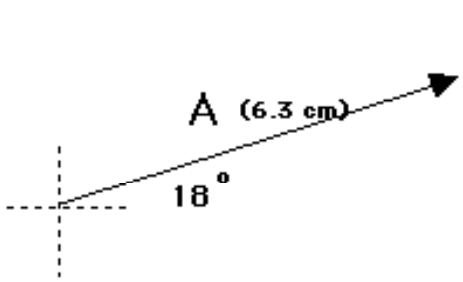
Adding **A** + **B** produces resultant $\mathbf{R_1}$:

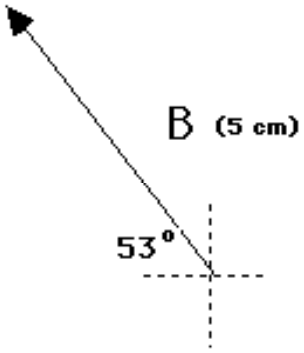


Subtracting **A - B** is the same as adding **A + (-B)**; this produces resultant $\mathbf{R_2}$:



Example 3.
Given the vectors shown:





Draw diagrams and find R for:
(a) A + B = R
(b) A - B = R
(c) B - A = R

(see Vectors Ex 3 for answer)